

A SUCCESSFUL “MOBILE SLUG AND SNAIL CONTROL DEVICE” BY PHYSICAL METHOD: AN INNOVATIVE IDEA AND ITS APPLICATION

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ABSTRACT

Slugs and Snails are belongs to the second largest phylum, Mollusca. They are an important crop and ornamental plant pest in horticulture and agriculture. In West Bengal there are many slug and Snail species which damage the agricultural field. There are so many traditional methods like chemical method, physical method, habitat modification, Traps, natural enemies etc. to control the snails and slug. But there is not a single method gives a satisfactory result. Our innovation is to control slugs and snails by Physical method (electric shock from cattle urine). By using Cu & Zn plate as electrode we produce 0.6V-0.9V electricity which protects the crop or agricultural field from soft bodied slug and snail. The cost of our present device is very low cost or no cost. The ranges of success were 87% - 98.33% and 79.2- to 92.33% in case of *Laevicaulis alte*, *Macrochlamys sp* respectively. The success rate is little bit higher in case of *Laevicaulis alte* then *Macrochlamys sp*. It is possibly due to presence of shell in the later species. The tolerance level also varied due to body size which is directly proportionate.

KEYWORDS: Slugs and Snails, Agriculture & Horticulture, Physical Method, Electric Charge, Cu & Zn Electrode, 0.6V-0.9V

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INTRODUCTION

Slugs and snails are not only common pests in West Bengal but a serious problem in total world. There are many slugs and snails species like *Laevicaulis alte*, *Achatina fulica*, *Macrochlamys sp.*, *Rhachis bengalensis*, and *Opeas gracilis*. (1, 2, 3, 6, 8, 13) makes a serious problem in the agriculture and horticulture in West Bengal. Farmers often experience difficulty controlling these pests with traditional bait pellets containing molluscicides such as methiocarb and metaldehyde. For example, in wet conditions the efficacy of these pellets can be very low (5) leading to unsatisfactory control levels. In further, poison baits can be toxic to other non-target soil invertebrates, as well as birds and mammals such as shrews and field mice (7, 10). The development of effective alternatives to conventional molluscicides, particularly those which could be used in an integrated control strategy, would reduce plant losses, improve plant quality and offer a sustainable strategy for controlling slug and snail pests with reduced molluscicide (14) input. Although Copper sulphate can act as one of the best chemical molluscicide still due to degradation of the soil quality by over use of that chemical that practice is not the suitable now a days. The development of alternative snail and slug control methods compatible with Integrated Pest Management (IPM) strategies used to control other pests will help satisfy increasing market demands for ornamental plants and edible crops grown with environmentally responsible production methods (4, 9, 12, 15, 16).

As a reason our innovation is to control the slug and snail species by Physical method (through electric shock from cattle urine). Our experiment was based on two species of snails and slug viz. *Laevicaulis alte* and *Macrochlamys sp.*

MATERIALS AND METHODS

The main areas of the present study are the Mahishadal, Dimond Harbour, Nayachar, Kukrahati, Geonkhali and Noorpur of West Bengal (GPS location: [DD (decimal degrees): Latitude: 22.1813597; Longitude: 87.98982049999995]; [DMS (degrees, minutes, seconds): Latitude: N22°10'52.895''; Longitude: E87°59'23.353'']) from 2012 June -2015 August.



Figure 1: Study Area of Our Innovative Method

BASIC PRINCIPLE

Basic principle of the present study is repelling the snail and slug by generating a low voltage electricity without using electric and when snail comes in contact with this electric field it will avoid the track. After trying one or two times in the same night the snail or slug leaves this field for that night. We create the electricity only from cattle urine which is totally biodegradable as well as undoubtedly act as good bio manure. If we keep two metallic plates such as copper and zinc in a beaker and put some amount of cattle urine in the beaker and measure the electricity it will show near about 0.6 to 0.9 volt. It may vary due to type of urine, type of plate etc. When the snail try to pass over the metallic plate it must touch the two and can complete the circuit and get electrified. In this time they release mush slime which is also act as more conductor. Again and again this snail and slug are shocked by the above electric and finally leave the station.

DESIGNING OF THE DEVICE

To produce mobile slug/snail control trap at first we needed waste PVC pipe having 2inch-2.6inch diameter with required length and four plastic angles for attach them in the field. By using blade, $\frac{1}{4}$ of the upper top circumference of the pipe were removed and remaining $\frac{3}{4}$ of the pipe looks like an open cannal around the seed bed or agricultural field or horticultural field. The area or size of the above rectangular structure can easily be varied by adjusting the length of the PVC pipe at any moment. The canal is strictly waterproof by using the pudding at the joining point. The $\frac{3}{4}$ th of the canals were field with cattle urine. Zinc and a copper foil having 1mm thickness, 12 cm height and length of required amount were attached at the two opposite opening of the canal of the pipe (cut edge) by using glue. The bases of both the plate must be touched with cattle urine. Special care should be taken to prevent the gap between pipe and the ground by the loose soil. When canal were formed around the seed bed or agricultural field the gap between Zn and Cu Plate will not more than 1c.m. For better result more plate should be used to get better electricity. The mobile model should be placed around the seed bed in the afternoon or evening giving the fresh urine. After 2 – 3 days when the urine will dried off

further fresh urine or fresh pond water may also be used. We checked the voltage difference by the Multimeter it was around 0.6V-0.9V. Our Innovative design is presented in Figure 2

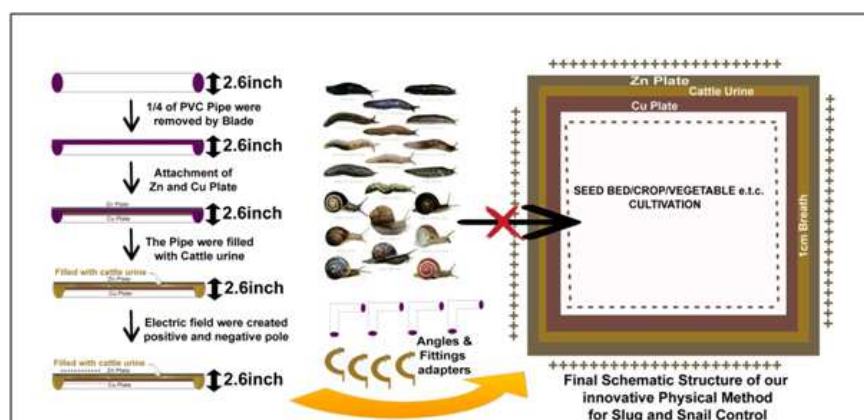


Figure 2: Schematic Diagram of Mobile Slug /Snail Control Device

For experimental evidence of this device working against slug and snail, we select 2 species (one slug and one snail species) viz. *Laevicaulis alte* and *Macrochlamys sp.* The sample snails and slugs were collected from the different local Garden and pond site in the evening and or morning, mainly in the rainy season. The field work was conducted in the study site during evening starting from the month of June/July with the onset of south-west monsoon because the rain stimulates the summer aestivating slugs and snails to emerge in large numbers. The animal was cultured in the laboratory during the period of study. *Laevicaulis alte* (2, 11) were 4.4cm to 6.5cm in length and the average value was 5.69cm and the \pm SD value was ± 0.67 cm. *Macrochlamys sp* were 0.7mm to 20mm in length and the average value was 12mm and the \pm SD value was ± 0.42 mm. (15). In a 100sq ft seed bed (40 ft perimeter) of different mixed vegetable were protected by this method and 300 snails and slug of each species were released around the seed bed. All the snails were starved for 24hrs. All the experiment were done overnight. The specimens were released at different four sides of the pipe in equal number to avoid any discrepancy, in the evening at 5.30 pm. At 6.30 am in the morning, the number of the snail present in the seed bed was counted by their physical presence. If there was no snail in the field, the shiny trails of the snail and slug were detected and counted near the border of the metallic plate. After this, suitable statistical analyses were done to test the efficiency of the device.

RESULTS

To test the effectiveness of our present mobile snail and slug control physical device we did the above experiment and performed 10 trails. Results were shown in table 1.

Table 1: Result of 10 Trials to Prevent the Attack of Snails and Slug (*L. Alte*, *macrochlamys Sp*) around Seed Bed (Mixed Vegetable and Citrus Fruit) by Using our Mobile Snail and Slug Control Device

| Trials | Number of Animal(Each) | Number of Snail/Slug Overcome the Device(Out of 300 of Each Type Snail/Slug) | | Number of Snail/Slug Prevented by the Device (Out of 300 of Each Type Snail/Slug) | | SUCCESS (%) of Mobile Snail/Slug Control Device | |
|----------|------------------------|--|------------------------|---|------------------------|---|------------------------|
| | | <i>L. Alte</i> | <i>Macrochlamys Sp</i> | <i>L. Alte</i> | <i>Macrochlamys Sp</i> | <i>L. Alte</i> | <i>Macrochlamys Sp</i> |
| Trial 1 | 300 | 5 | 45 | 295 | 255 | 98.33 | 85 |
| Trial 2 | 300 | 24 | 62 | 276 | 238 | 92 | 79.33 |
| Trial 3 | 300 | 15 | 29 | 285 | 271 | 95 | 90.33 |
| Trial 4 | 300 | 37 | 74 | 263 | 226 | 87 | 75.33 |
| Trial 5 | 300 | 29 | 37 | 271 | 263 | 90 | 87.67 |
| Trial 6 | 300 | 21 | 47 | 279 | 253 | 93 | 84.33 |
| Trial 7 | 300 | 17 | 23 | 283 | 277 | 94 | 92.33 |
| Trial 8 | 300 | 0 | 39 | 300 | 261 | 100 | 87 |
| Trial 9 | 300 | 11 | 28 | 289 | 272 | 96.33 | 90.6 |
| Trial 10 | 300 | 33 | 42 | 267 | 258 | 89 | 86 |
| Total | 3000 | 192 | 426 | 2808 | 2574 | 934.66 | 857.92 |
| Average | 300 | 19.2 | 42.6 | 280.8 | 257.4 | 93.47 | 85.79 |

The result shows that in ten trial run out of total 3000 snails and slug a total of 2808 and 2574 snails and slugs (*L. alte*, *Macrochlamys sp* respectively) were prevented by this method which indicates the success percentage is 93.46 and 85.79 respectively. So only 6.5% and 14% *L. alte*, *Macrochlamys sp* were able to overcome this barrier and reach the target plant species. The success rate also depends on either the presence or absence of the other alternative host plant species. The ranges of success were 87% - 98.33% and 79.2- to 92.33% in case of *L. alte*, *Macrochlamys sp* respectively. The success rate is little bit higher in case of *L. alti* then *Macrochlamys sp*. It is possibly due to presence of shell in the later species. The tolerance level also varied due to body size which is directly proportionate.

DISCUSSIONS

From the above experiment we can test the effectiveness of our mobile snail and slug control device and get a significant result to control the pest snails and slug species. From this trial 1 to 10 we get percentage of success in case of *L. alte* were respectively 98.33, 92, 95, 87, 90, 93, 94, 100, 96.33, 89 on an average of 93.47% and in case of *Macrochlamys sp* percentage of success respectively 85, 79.33, 90.33, 75.33, 87.67, 84.33, 92.33, 87, 90.6, 86 on an average of 85.79%. The result shows that in ten trial run out of total 3000 snails and slug a total of 2808 and 2574 snails and slugs (*L. Alte*, *Macrochlamys sp* respectively) were prevented by this method which indicates the success percentage is 93.46 and 85.79 respectively. So only 6.5% and 14% *L. alte*, *Macrochlamys sp* were able to overcome this barrier and reach the target plant species. The success rate also depends on either the presence or absence of the other alternative host plant species. The ranges of success were 87% - 98.33% and 79.2- to 92.33% in case of *L. alte*, *Macrochlamys sp* respectively. The success rate is little bit higher in case of *L. alti* then *Macrochlamys sp*. It is possibly due to presence of shell in the later species. The tolerance level also varied due to body size which is directly proportionate. To control other snails slugs which are responsible to spread in human and nonhuman disease (11), this model can work and that have to be tested in future.

So in case of *L. alte* this method is more effective than *Macrochlamys sp.* So our innovative model or method is more effective in slugs than snails because whole body part of the slugs is soft and no outer shell. The success rate of our trapping method is very high. This model is flexible that means it can shifted to one garden to another. In our area we already motivate some farmers to use it and they are used this method successfully.

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FURTHER WORK

We want to see the effective rate of this barrier on other arthropods as well as other molluscs. We also want to do the experiment in different environmental condition, different soil parameter, and climatic changes in different geographical region by data base study.

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